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METHOD FOR HARD-SURFACING METAL EDGES

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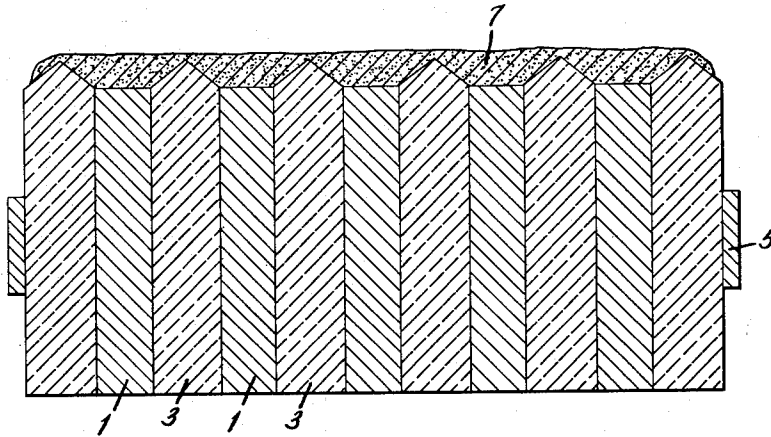


Fig. 1.

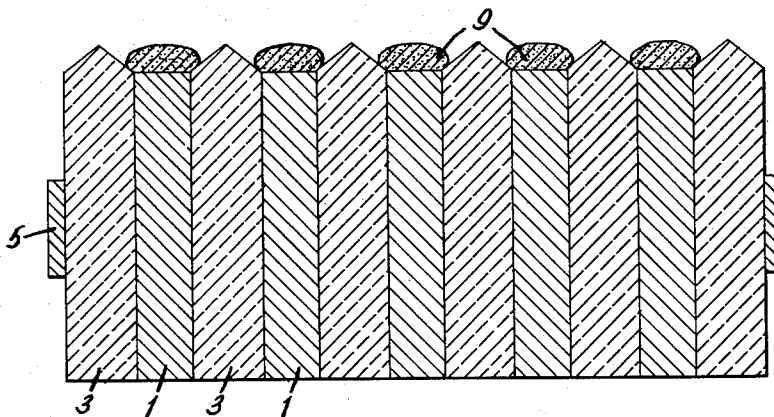


Fig. 2.

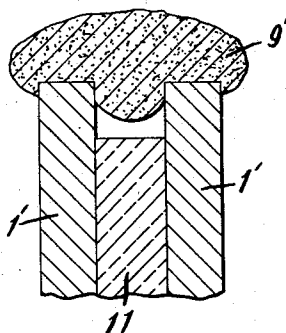


Fig. 3.

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METHOD FOR HARD-SURFACING METAL EDGES
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The present invention relates to an improved method for hard-surfacing the edges of metal articles such as knives, chisels, surgical instruments, chain saw guide-bars and the like. More particularly, the present invention relates to an improved method for simultaneously hard-surfacing the edges of a plurality of similarly shaped metal articles of the class described.

At present, spray hard-surfacing is a widely employed technique for rendering the edges of metal articles abrasion-resistant. The technique of spray hard-surfacing as it is generally practiced comprises preparing a metal work piece by cleaning and roughening the surface, for example by blasting with aluminum oxide; subsequently directing a forced flow of metallic powder at high temperature at the prepared surface to form a deposit thereon; and ultimately fusing the deposited metallic material by suitable means such as an oxyacetylene torch or induction heating equipment. When applying a deposit of nickel-base alloy or tungsten carbide, the stream of powders is usually pre-heated to about 1200° F. while a pre-heat temperature of about 1500° F. is preferred when depositing cobalt-base alloy powders.

As a result of the fusing operation, the deposited metallic powder shrinks about 15 percent in volume and becomes strongly bonded to the edge of the work piece and provides a hard surface which is highly resistant to heat, abrasion, oxidation, corrosion and thermal shock.

In view of the economic and other advantages which are characteristic of the aforementioned spray hard-surfacing technique, efforts have been made by the art to provide a method for efficiently and simultaneously hard-surfacing the edges of a plurality of similarly shaped metal articles.

A hard-surfacing method which is typical of the prior art efforts in respect of this problem comprises closely arranging the metal pieces to be treated in a stack with recessed spacers being arranged between the metal pieces; depositing hard-surfacing metallic powder on the edges of the stacked metal pieces, and heat treating the deposited hard-surfacing metallic material to cause fusion thereof as a result of which the hard-surfacing metallic material becomes strongly bonded to the edges of the metal pieces and experiences a reduction in volume.

After the heat-treating step, the stacked metal pieces are separated and the hard-surfaced edges are machined to the desired dimensions.

A difficulty encountered in the above-described hard-surfacing operation is that after the heat-treating step the hard-surfacing substance forms a complete or partial bridge of fused material between the stacked metal pieces. Under these circumstances it is necessary to first detach the hard-surfaced metal pieces before final grinding and preparation for their ultimate use. Consequently a time-consuming and economically detrimental after-treatment is required which detracts from an otherwise highly advantageous and relatively simple process.

It is therefore an object of the present invention to provide an improved method for simultaneously hard-surfacing a plurality of metal articles whereby adhesion between the individual hard-surfaced articles is avoided.

Other objects will be apparent from the following description and claims taken in conjunction with the drawing in which:

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FIGURE 1 shows a stack of metal pieces arranged in accordance with the present invention onto which metallic hard-surfacing powder has been deposited

FIGURE 2 shows the arrangement of FIGURE 1 after fusion of the deposited material and

FIGURE 3 shows a stack of metal pieces which have been hard-surfaced without the benefit of the present invention.

The improvement in the aforementioned process for simultaneously hard-surfacing metal articles which is provided by the present invention is the utilization of spacers between the stacked metal articles which spacers extend beyond the edges to be hard-surfaced and which are adhesion-resistant to the hard-surfacing material.

In the present invention, the spacers are extended beyond the metal edges to the extent such that after the heat-treatment of the applied hard-surfacing material and the resultant reduction in volume thereof due to fusion, all of the hard-surfacing material bonded to the metal pieces is confined between the spacers and the undesirable bridging effect is thereby eliminated.

In a specific embodiment of the present improved process, by wedge-shaping or tapering the extending portions of the spacers, the necessary amount of spacer extension is minimized and the application of the hard-surfacing material is facilitated.

The present invention will be more clearly understood with reference to the drawing which shows in FIGURE 1 a stack of closely spaced metal pieces 1 which can for example be plain carbon steel guide-bars which are required to be hard-surfaced for use in chain saw apparatus. The metal pieces 1 are separated by spacers 3 which extend beyond the edges of the pieces which are to be hard-surfaced. Clamps 5 are provided to secure the stacked metal pieces and spacers.

In order to achieve economy of operation, the separation between the metal pieces is usually quite small, i.e. less than about 1/4 inch. The spacers are preferably formed of asbestos although copper and other materials, such as surface-oxidized metals and organic compositions which can withstand the temperatures involved, are also suitable. A particular alloy which is suitable as the spacer material has a composition of 0.5 to 2.5 percent cobalt, 20.5 to 23 percent chromium, 8 to 10 percent molybdenum, 0.2 to 1 percent tungsten, 17 to 20 percent iron, 0.05 to 0.2 percent carbon, up to 1 percent silicon, up to 1 percent manganese, the balance being substantially all nickel.

After the metal pieces and spacers are arranged as illustrated, a forced stream of hard-surfacing metallic powder, suitably pre-heated, is sprayed on the edges of the metal pieces to form a deposit of hard-surfacing material indicated as 7 in FIGURE 1. The spraying and pre-heating of the hard-surfacing material can be accomplished by means of any of the well-known spray-gun devices manufactured and sold for this purpose.

After the metallic deposit 7 has been formed, it is heated and fused by an oxyacetylene torch or other suitable means whereby the hard-surfacing material is strongly bonded to the metal pieces and shrinks in volume about 15 percent as indicated as 9 in FIGURE 2. Due to the reduction of volume and the presence of extending spacers 3, the fused metal which is bonded to the metal pieces is confined between the spacers and thereby prevented from bridging the metal articles. The wedge-shaping or tapering of the spacers as illustrated assists in avoiding bridging by "cutting through" the contracting hard-surfacing material during the fusion operation.

The resulting hard-surfaced metal pieces which are thus formed can be readily disengaged from the spacers and machined to the desired dimensions without requiring further treatment.

FIGURE 3 is provided to illustrate the condition which results with the use of recessed spacers 11 instead of the extending spacers of the present invention. As can be seen, the hard-surfaced metal pieces 1' produced in this manner are rigidly connected by fused hard-surfacing material 9' and are not capable of being directly utilized or machined without considerable pre-treatment.

In the practice of the present invention it has been found that the present invention, while not limited thereto, is particularly effective for hard-surfacing articles, particularly steel articles, with the following hard-surfacing powders:

NICKEL ALLOY POWDER

	Percent
Chromium -----	9 to 17
Silicon -----	3 to 4
Carbon -----	0.045 to 1.0
Iron -----	1.5 to 4
Boron -----	2.0 to 3.3
Nickel -----	Balance

COBALT ALLOY POWDER

Chromium -----	21
Silicon -----	1.6
Carbon -----	0.1
Boron -----	2.4
Tungsten -----	4.5
Cobalt -----	Balance

COMPOSITE POWDER

Nickel alloy powder -----	50
Tungsten carbide powder -----	50

The following example is provided to illustrate the present invention.

Example I

Several plain carbon steel chain saw guide-bars $\frac{1}{8}$ inch thick are arranged in a stack together with spacers in the manner illustrated in FIGURES 1 and 2 of the drawing. The spacers are about $\frac{5}{16}$ inch thick and are formed of copper. The wedge-shaped portions of the spacers extend $\frac{1}{16}$ inch above the stack.

A layer of cobalt-base alloy powder about $\frac{5}{64}$ inch thick is deposited on the stack by means of a spray-gun device in which the powder is pre-heated by an oxyacet-

ylene flame. The composition of the powder is as follows:

	Percent
Chromium -----	21
Silicon -----	1.6
Carbon -----	0.1
Boron -----	2.4
Tungsten -----	4.5
Cobalt -----	Balance

The deposited layer is subsequently fused by means of an oxyacetylene torch at a temperature of about 2100° F. to 2200° F.

As a result of the fusion, the deposited metal contracts in volume and becomes strongly bonded to the guide-bar edges. All of the material which thus bonded to the edges is "cut-through" by the spacers and is entirely confined between the spacers.

From the foregoing description it can be seen that the present invention provides a simple and economical method for simultaneously hard-surfacing a plurality of metal articles whereby the necessity for further treatment prior to final machining is avoided.

What is claimed is:

1. In a process for providing an adherent hard-surface on metal edges by stacking together a plurality of metal pieces, depositing a hard-surface metallic powder in contact with selected edges of the metal pieces and heat-treating the deposited hard-surfacing metallic material whereby the hard-surfacing metallic material is fused and bonded to the selected edges and reduced in volume, the improvement which comprises inserting spacers between adjacent metal pieces prior to the deposition of the hard-surfacing metallic powder thereon, said spacers being adhesion-resistant to the hard-surfacing material and extending beyond the selected edges of the metal pieces and into the subsequently deposited hard surfacing metallic powder to the extent that, as a result of heat treatment of the deposited hard surfacing metallic material and the consequent reduction in volume thereof, said hard surfacing metallic material is cut through by the spacers.

2. A process in accordance with claim 1 wherein the extending portions of said spacers are tapered outwardly from the stacked metal pieces.

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